Social Network Analysis and Communities of Practice

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INTRODUCTION

Social network analysis (Scott, 2000; Wasserman & Faust, 1994) is a relatively new theory and methodology that has found wide application in social science research. In the early 2000s, an increasing number of scholars have been interested in computerized Social Network Analysis (SNA) and have adopted social network theory and techniques to study communities of practice (CoPs). In this article, the authors introduce SNA from a historical perspective, compare SNA with non-network theories and methods, and introduce popular SNA software packages. With reference to recent empirical research, the authors discuss several areas in which SNA has been applied to CoP research.

BACKGROUND: SOCIAL NETWORK ANALYSIS

SNA is a set of theories and methods used to uncover, map, and analyze the underlying structure of relationships that bind people, and other human and non-human actors, together within and across groups, organizations, and communities. SNA has gained momentum since the 1950s as a result of increased use of mathematical, statistical, and computing methodologies in conjunction with social behaviour theory to model and explain patterns of social interaction within or across organizational settings (see, for example, Mitchell, 1969). With the rapid development of graph theory (Harary, 1969) and the dramatic increase in computing capabilities during recent decades, SNA has found important applications in modelling the spread of contagious disease, diffusion, and communication of technological and administrative innovations, relational nature of competitive advantage, intra- and inter-organizational relations, the nature of social support, including CoPs, to name but a few areas of interest.

Generally, a social network refers to a social system constructed by a collection of actors, relations among these actors (e.g., friendship, knowledge exchange), and possible attributes (e.g., age, sex) for each actor. SNA assumes that the actors in a social system are not isolated but have linkages with others, each of whom in turn is linked to a few, some, or many others. How actors behave depends on how they are linked with others and where they are located in the whole network. In this sense, SNA seeks to describe, understand, and model the relationships among actors either at the personal level or at the group level, using metrics at the actor level (e.g., centrality) or the group level (e.g., density). The overall aim of SNA is therefore to analyse and explain how the relationships among sets of actors (i.e., dyads, triads, and larger subgroups) and the structure of relationships of a whole group influence individual behaviour, as well as the functioning of a group as a whole.

In SNA, the observed attributes of social actors are primarily understood in terms of their relational content. The unit of analysis is not, for example, an individual but a relation (e.g., advice) connecting two (or more) individuals. As a result, SNA focuses on a collection of individuals and the set of linkages among them with respect to one (or more) relations. The inclusion of information on relations among groups of actors is the fundamental feature differing SNA from other non-network methodologies such as statistical analysis with its primary focus on attribute data (e.g., age, sex) with no relational content (Scott, 2000).

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As a result of this distinction, a non-network theory based on statistical analysis, as in neo-classical economic theory of self-interested profit maximizing actors, the units of analysis, regardless of whether they are people or organisations, are viewed as isolated, independent, and unrelated, and researchers implicitly assume that actors do not influence each other, as if they are undersocialised and disembedded from any kind of social system (Granovetter, 1985). However, from a SNA perspective, it is assumed that the economic behaviour of actors mainly arises from ongoing structural and relational workings of a social system (Wellman & Berkowitz, 1988). Researchers primarily focus on the properties of the network, community, or social system, rather than attributes of individual actors. The attribute data of individual actors only help to add additional explanatory power with statistical methods complementing SNA methods and metrics.

The relational data of SNA are measured in terms of two properties: whether a linkage is binary or valued, and whether it is directional or nondirectional. The directional valued data contains more information than the nondirectional binary data, which only presents the absence or presence of the linkage between two actors. Questionnaire survey is suggested to be the most pragmatic approach to collect relational data in organizational settings (Cross, Borgatti & Parker, 2002). Relational data are often stored in data matrices, called sociomatrices, suitable for electronic computing. Besides such measures as mean, median, standard deviation, and so forth borrowed from statistics, SNA provides a set of quantitative concepts and related techniques to analyze relational data. For example, the term *centrality* measures how critical an actor is in a network; *density* measures how closely a group of actors are connected, and *centralization* measures how variable or heterogeneous the actor centralities are (see also, Key Terms, at the end of this article). Many other advanced concepts, for example, structural equivalence, component, role, and position, are also widely used in SNA research.

Most of the mathematical calculations of SNA can be done by a variety of off-the-shelf computer SNA software packages. Scott (2000) suggests that GRADAP is good at handling fairly large data sets; STRUCTURE is slightly more user-friendly; UCINET has many powerful features, and it is fast and efficient with a wide range of measures available; PAJEK is able to handle and analyze very large data sets. UCINET (Borgatti, Everett & Freeman, 2002) is the most widely used SNA software, and it is regarded by many researchers as the best for network analysis and visualization. It was developed by a group of network scholars at the University of California, Irvine (UCI). It is a general purpose and easy to use package covering a wide range of graph theoretical concepts, positional analysis, and multidimensional scaling (MDS) routines. Its functions for cohesion, components, centrality, subgroup, role, and position analysis are well designed and widely used.

CoP AS SOCIAL NETWORKS

A community of practice (CoP) is a collection of tightly intertwined interpersonal networks. As stated by Wenger, McDermott, and Snyder (2002), "the heart of a community is the web of relationships among community members, and much of the day-to-day interaction occurs in one-to-one exchanges" (p. 58). The CoP members are therefore linked by ongoing dyadic relations and the daily social interactions which form a well knit network of interpersonal relationships. Generally, interaction among CoP members is more intensive than in ordinary informal networks so that a CoP "could be in fact viewed as nodes of 'strong ties' in an interpersonal network" (Wenger, 1998, p. 283).

However, a CoP is more than just a set of interpersonal relationships. It is "not defined merely by who knows whom or who talks with whom in a network of interpersonal relations through which information flows" (Wenger, 1998, p. 74). The common practice gives the community members a knowledge domain, a shared identity, and cohesiveness to sustain interactions over time. CoPs are closely associated with a collective ongoing practice, in which interpersonal relationships are built up as a result of continuous knowledge generation and exchange. Thus, it is argued that every CoP consists of one (or many) social networks, but not every social network forms a CoP (Schenkel, Teigland & Borgatti, 2001). Moreover, CoPs are regarded as knowledge creation and sharing networks (Cross, Prusak &

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